Integration of Logistics Resources Based on Logistics Network

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Abstract: Because of the urgency and limitations of the integration of our logistics resources, from the perspective of overall logistics system, it is put forward that logistics network structure is the basis for integration of logistics resources, and the integration model of the logistics resources based on logistics network are researched in this paper. Through the analysis on logistics network structure, three-phase and three-dimensional structure model of logistics resources integration are constructed, which is the theoretic foundation for optimization of logistics resources allocation, improving the utilization of logistics resources and enhancing the operating efficiency of logistics network.

Keywords: logistics resources, logistics network, logistics network structure, resources integration

1 Introduction

Logistics industry is still in early stage of the development in our country, there are several problems to be solved. Logistics basic establishments and equipments are of elementary scale, but the management level and efficiency are lower. Most industries themselves take on logistics tasks, and the initial harmony and cooperation are lacking, so the resources are dispersed, and the serving level is low, and it is difficult that the market demand is met quickly. The transits and logistics crunodes are not reasonable, and the information systems are out of date, and the criterion is not uniform, so the interrelated information can not be fed back in time. The uniform management is lacking among the logistics industries, and the partition management model can lead that logistics dynamic demand is reflected insensitively, which blocks the advance of serving level and development of logistics industry. The demand of market is more and more exigent for the speed of resources currency and serving quality, and the existing logistics serving level is the important factor of restricting the development of logistics industry. It is urgent to meet the demand of clients completely and enhance the using efficiency of the logistics resources through the integration of resources and optimization of resources allocation, which can not only exert the scale advantage and whole efficiency of the logistics resources, but also reduce logistics cost, and enhance logistics serving level, and increase social economic benefits.

At present, the research on resources integration at home and abroad is mainly in three aspects: integration research aiming at logistics resources of a trade, an area or an enterprise group, such as Haitao R and Xuanxi N (2009) researched on coal logistics resource integration model [16], Yongqing L. (2009) researched on the integration of logistics in the Chang-zhu-tan City Group [13], and Liqiang L(2009) developed a study on the logistics integration of enterprise Group [11]. Jeffers (2010) and Yang S. (2008) researched on integration model from the aspect of third party logistics or fourth party logistics [6, 18]. Laureano (2006) and Chao H. (2005) studied on information-based logistics resources integration and construction of information platform based on grid technique [1, 5]. Usually, integration of internal and external resources is researched to enhance the enterprise competition, and the resources often include client resources, capability resources, organization resources, information resources and the operation flow, but the resources integration is not established in logistics system. When we study the logistics system, if system theory is not applied as the guide line, the validity of resources integration couldn’t be high, and the effect will be not so good as we expect. So logistics resources integration is very important to make systematic, information, collaboration of logistics
resources integrate in one, which can optimize the structure of logistics network, and avoid the waste of resources and time. At the same time, it is a difficult task for us to settle. Based on the development requirement of our logistics industries and the research status at home and abroad, it is illuminated that the network structure of logistics system is the base of logistics resources integration in this paper, and the logistics network is analyzed carefully, then the three phases are put forward during the integration of logistics resources, and the three-dimensional model of resources integration based on logistics network is established, which can show the logistics resources on the network to optimize the resources allocation.

2 The Theoretical Base for logistics Resources Integration

2.1 The meaning of logistics resources integration
The so-called integration is the course that the structure of business is reconstructed and become a new whole [14,15]. Now, the resources integration is only regarded as resources combination [12]. However, the integration of logistics resources should not be regarded as the collection and pileup of logistics resources, but a course to build a well-regulated resources system. During the optimization of logistics system, the integration of logistics resources is the activities that the dispersive logistics resources of logistics system are analyzed and the relative elements are summed up and integrated to form a cooperative whole based on the common goal and information sharing, which can improve the comprehensive service capabilities.

2.2 The signification of logistics network
System structure is the base for the integration of logistics resources, which is the important foundation for the system with integrality and function. System is composed of isolated elements through structure, and it is provided with system function [2]. Resources integration is the guide line of modern logistics network research, which is the inevitable trend of modern logistics development, and logistics network is the effective method for resources integration [7]. Resources integration and optimization can be presented clearly in logistics network. Logistics network theory is the new field of logistics theoretic research, and it is the effective approach for resources integration and sharing [17]. So system theory is the foundation for constructing logistics network. Only if the whole logistics network becomes the research object, the optimization is the global optimization, not the part optimization, which can improve the using efficiency of logistics network resources, achieve the integration and optimization of logistics resources.

2.3 Analysis on structure of logistics network
Logistics network originates from logistics system, which is the visual form of logistics system to emphasize the network characteristics. Logistics network structure determines the function of logistics resources allocation, and the operation of logistics network is the implementation process of the logistics system functions. According to the operation mode and process of logistics network, in this paper, logistics network is divided into horizontal infrastructure network, logistics organization network, logistics information network and vertical logistics demand network, logistics function network, target customer network.
Infrastructure network includes the transit nodes of logistics system (logistics centers, warehouses, stations, docks, aviation ports etc.) and lines (railways, highways, waterways, flight courses, pipelines). Logistics organization network includes logistics system dynamic relationship and the component elements (materials supply enterprises, transport enterprises, target customers), and this relationship depends on logistics demand, which makes logistics demands, logistics functions and target customers organize into temporary dynamic logistics chain, and only goods circulation can generate the corresponding organization network. Logistics information network is the information sharing mechanism among enterprises, which includes both the message of logistics network elements and the
external social environmental information of logistics network, and which is the key of logistics network resources integration. Therefore logistics organization network is based on infrastructure network, and logistics information is in the organization network and the infrastructure network, which constitute the horizontal logistics network.

Logistics demand network is the collection of all the logistics demand, and it is variational with the change of logistics demand. Logistics demand is the driving force of the logistics network operation, and the purpose is to meet the logistics needs of the community. Logistics function network is the aggregation of the function of logistics infrastructures and logistics enterprises, including all the necessary functions in logistics activities, which is the bridge between logistics demand network and target customer network. Target customer network is the collection of goods destinations. Goods destinations can be regarded as the property of logistics demand, but in order to visually reflect the logistics process, Target customer network is put forward solely.

Horizontal composing and vertical composing are in logistics network, which is shown in Figure 1. The horizontal composing determines the transport capacity of logistics network. The vertical composing determines the transport efficiency of logistics network, which is the course to optimize the transport. Only both the horizontal and vertical logistics network are studied in a logistics region, a logistics network system with “systematized resources, structured organization, integrated function, regionalized service” will be formed.

![Figure 1: Composing of logistics network.](image_url)

3 The Principles of Logistics Resources Integration

1. Systematic principle. To carry out logistics resources integration, it is necessary that according to the logistics demand we coordinate the logistics resources to achieve overall system effects with systemic thinking. Therefore, when the principle is applied into logistics resources integration, a systemic boundary should be identified so that the integration can be carried out easily.[19]

2. Holism principle. Logistics network resources integration should have a definite object in view. The overall logistics system should become the research object in the resources integration, and the integration on one single factor or part of the elements is obviously meaningless for the implement of the overall systemic function. Only if the elements of logistics system are integrated clearly in the network structure, the objective of the integration will come true, and we can realize the logistics resources cooperation.

3. Standardization principles. Logistics standardization is the important means to achieve modernized logistics management. Only if we unify the standards of the whole logistics system, all the elements and networks can achieve the information sharing and cooperation with each other. There are some main criteria to involve, for example, logistics unit standard, logistics professional term standard, logistics statistical accounting standard, logistics technique standard, logistics working standard.[3]

4. Opening principle. Any element in logistics network is an open functional body, and each element has the core functions and it can share resources and information with other elements of the network.
4 Logistics Resources Integration Based on Logistics Network

According to the structure of logistics network, in this paper, logistics resources integration is divided into three phases. The first is the element integration of logistics network, namely, the capabilities and information integration of all the elements of logistics network. The second is the horizontal logistics network resources integration, that is to say, the gather of functions among the similar elements and the information sharing among the heterogeneous elements. The third is the vertical logistics network resources integration. According to the logistics demand, the elements of logistics network create a dynamic alliance and a directed network flow. The three phases of logistics network resources integration are shown in Figure 2.

4.1 The element integration of logistics network

Through the logistics network elements themselves were analyzed, the integration is mainly in the following areas:
1. To determine the functions and capabilities of the logistics network elements.
2. To determine the using status of function of logistics network elements.
3. To determine the cost and using condition of logistics network elements [4].
4. To establish the management information system of logistics network elements in the same network technique standard.

![Image](Integration of logistics network elements)

**Figure 2: The three phases of logistics network resources integration.**

The functions of logistics network elements comprise the functions of material resources, such as the capacity of storehouse, the number of transport devices, and the intangible skills, including freight organization modes and capabilities, and the management capabilities, such as manager and abundant experience of logistics management[10]. During the integration of logistics network elements, we must emphasize the core function of each element to determine its using status, using cost and using condition, and all the information of logistics network elements is managed by the management information system with the uniform standard.

4.2 Horizontal integration of logistics network resources

The horizontal integration of logistics network resources is a hierarchical integration of logistics network elements, which programs all the elements of logistics network with a certain system to realize the relation of logistics network elements at the same level, and enlarge the scope of cooperation among the logistics network elements, and enhance the connectivity of logistics network. According to the structure of logistics network, horizontal integration of the logistics network resources is divided into the integration of infrastructure network, the integration of logistics organization network and the integration of logistics information network.
1. The integration of infrastructure network. The infrastructures of logistics network are integrated from the angle of its zone and functions. Because the infrastructures are dispersed in a zone, it is necessary to determine the types, numbers, functions of logistics infrastructures and the feasible transport mode among the infrastructures.

2. The integration of logistics organization network. The organization network is the collection of all the relations, and these relations are to meet the logistics demand. During the integration of logistics organization network, it is necessary to determine the condition of goods on road and the status occupying the network resources in a certain period of time.

3. The integration of logistics information network. The integration of logistics information network is the key in the integration of logistics network resources, and it is the important technique support for the running of the logistics network, which includes all the information of each element in logistics network system, and the fusion and sharing of the information among the elements can supply the prerequisite for the integration of logistics network resources.

4.3 Vertical integration of logistics network resources

The vertical integration of logistics network resources can generate the better configuration and optimal use of the logistics function network based on the logistics demands and Target customers, which can make the resources of logistics function network selected, coordinated and optimized, in order to complete the logistics tasks together with the same goal and a good strategy.

1. The integration of logistics demand network. Logistics demand is the impulsion for the integration of logistics network resources. The effective integration is important for the overall efficiency of logistics network. The integration of logistics demand network should be carried out from the logistics demand with a certain function in a certain period of time and a certain area.

2. The integration of logistics function network. The integration of logistics function network includes not only the integration of all the nodes of logistics network and the surrounding transportation routes, but also the integration of certain of function elements that can meet a certain logistics demand. The gather of certain function elements that can meet a certain logistics demand can be called a function body, and the logistics function network is the gather of all the function bodies. In Figure 3, the dots on the real line and the broken line in the logistics function network stand for the two function bodies of the different logistics demand.

![Figure 3: Effect diagram of logistics network resources integration.](image)

3. The integration of logistics target customer network. The integration of logistics target customer network is the demand integration in space; time and amount of goods during the goods need to be carried to the target customer. Only if the target customer demand is determined, the network resources are organized and allocated in reason for transport and distribution of goods. In the logistics
network, certain of logistics demands are changed into the logistics output in another space and time under the effect of the logistics function network, which is one of results of the integrated of logistics network resources, shown in Figure 3.

4.4 The relation among the three phases of Integration of logistics network resources

In the first phase, the elements of the logistics network are integrated themselves, which supplies the foundation and technique support for the latter two phases. In the phase of the horizontal integration, the elements of the logistics network are integrated at different levels and space, which is the rudiment of the convergence and dynamic alliance of logistics network resources. The phase of the vertical integration is the kernel phase. The horizontal logistics network resources can generate the dynamic alliance of logistics resources under the effect of the logistics demand, and the vertical logistics network can realize the coordination and operation of the different dynamic alliance in logistics function network to form the function bodies of the logistics network for the logistics demand. The horizontal integration and the vertical integration impact each other, which are shown in the following aspects.

![Figure 4: Three-dimensional structure model of logistics network resources integration.](image)

1. The integration of infrastructure network resources supplies the foundation for the integration of the logistics function network resources.
2. The integration of logistics organization network resources makes the demand network, the function network and the target customer network vertically integrated into the optimum decision-making.
3. The integration of logistics function network resources makes the capabilities of the Infrastructure network and the using status of the logistics organization network horizontally integrated into a whole with the technique and the management of the logistics information network.

The horizontal and vertical integrations of logistics network resources form the three-dimensional structure model of logistics network resources, and it is shown in Figure 4. The flow dimension is the vertical integration of logistics network resources, and the level dimension is the horizontal integration of logistics network resources, and the space dimension stands for the special scope of the integration of logistics network resources.

5 Conclusion

The integration of logistics resources is the premise of collaborative optimization of logistics network, which is to achieve the better operation of the logistics network through all the elements are integrated into a whole, and it can improve the operation efficiency. In this paper, based on the theory and principles of the integration of logistics resources, it is put forward that the integration of logistics resources is divided into the three phases, and under the effect of the logistics demand, the enterprise-centered integration mode of logistics resources is changed into the integration mode that regards the optimum collocation of the logistics resources as the core. The horizontal and vertical integrations of
logistics network resources form the three-dimensional structure model of logistics network resources in certain scope, which can make the logistics resources integrated on the logistics network. It can reduce the logistics cost, improve the stability of the logistics network, realize the dynamic alliance and the collaborative operations, enhance the service efficiency and the service level.

The integration of logistics network resources is the integrations of all elements of logistics network and all subnets, and the information and functions of any element or subnet can change with the logistics activities. In order to master the status and the using condition of the logistics network resources, it is necessary to develop a management information system. The integration of logistics network resources is the early task of the optimization of logistics network. Only based on the integration of logistics network resources, the various optimization methods of logistics network are significative.

References

[1]. Yonglan C. Research on Resources Integration of Urban Logistics Based on Griddization Management. Beijing, Beijing Jiaotong University, 2009. in Chinese
[12]. Weihua L. Logistics Resources Integration: Difficult or Inflection Point?, International Business Daily, 2008-2-18(B03). in Chinese
[14]. Micheal E. Porter’s Lecture[R], Innovation Theory, June 2003 in Taiwan. in Chinese